MIST-NET CAPTURE AND FIELD OBSERVATIONS ON THE SHORT-NOSED FRUIT BAT (CHIROPTERA: PTEROPODIDAE) *CYNOPTERUS SPHINX* (VAHL.)[1]

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(*With three text-figures*)

Key words: *Cynopterus sphinx*, mist-netting, foraging pattern, reproductive cycle, body mass

The present paper addresses the abundance, composition, reproductive status and body mass of adult males and females of the Indian short-nosed fruit bat *Cynopterus sphinx* captured by mist-netting. Both sexes exhibit peak foraging activity once before midnight, followed by another small foraging bout before dawn. Reproductive activity occurred twice in a year and the body mass cycle of females showed a predominantly bimodal pattern.

Introduction

In an animal population, the location, numbers, density, age and sex composition alter at different times of the year because of differential death rates, and other factors such as migration. This variation also depends on interaction with other factors such as food availability, predator pressure, inter- and intraspecific competition.

Alcock (1989) reported that mark and recapture studies are useful, in mobile animals, to study behaviour such as dispersal, migration, and foraging patterns. Chiropterans (both micro- and mega-) can be captured with mist-nets while they forage (Gaisler 1973, Heidman and Heany 1989). Mark and recapture studies were done by Fleming (1988), and by Kunz and Brock (1975) to observe activity patterns and social behaviour. Cosson (1995) reported megachiropteran flight activity level under forest canopy in South Cameroon by mist-net studies.

In the present study, the abundance, composition, reproductive status, foraging activity and body mass of adult male and female Indian short-nosed fruit bat *Cynopterus sphinx* were assessed, in relation with habitat and seasons through mist-netting.

Methods

The study was carried out from October 1995 to September 1997 in South India (8° 44' S, 77° 42' E). Nylon mist-nets of 9 m x 2.6 m with a mesh size of 38 mm were used to capture the bats from dusk to dawn, for 76 nights, at 23 different roosting and feeding areas (Avinet-dryden NY 13053 - 1103, USA). The mist-nets were placed away from illuminated areas so that the bats could not see them. The nets were set up as recommended by Kunz and Brock (1975) at 4 m above ground level. They were tied about half an hour before sunset and removed at 0600 hrs. The bats, which were trapped in the mist-net were removed immediately with gloved hands and placed in cloth bags, measured and released.

Whenever a large number of bats were captured within a short duration, they were placed in a holding cage with fruit to calm them down. Forearm length (using 150 mm vernier calipers) and body mass (using 100 g Salter

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spring balance), were measured. Also, the sex and reproductive condition (testes size in males, palpation in females) were determined. The captured bats were marked with a necklace (Balasingh *et al.* 1992) with ten different coloured beads representing numbers 0 to 9. The necklace was secured around the bat's neck, by crimping it with a copper ring, with long-nose pliers.

Recaptures were made periodically by repeated mist netting at different times over the season at the same study site. By comparing the data collected while marking with that of the recapture, the differences in their reproductive condition, forearm length and body mass could be analysed.

Results

A total of 1,393 bats were captured, of which 1,289 were *Cynopterus sphinx*. The captured bats were categorized as adult females, adult males, and juveniles. Peak foraging activity occurred during 2200 to 2300 hrs, followed by another small foraging bout during 2400 to 0500 hrs (Fig. 1). The year-round mist-netting programme revealed that *C. sphinx* emerges at 1815 hours at dusk and returns to day roost at 0515 hours.

No significant difference in body mass was observed in male bats, but two predominant peaks were obtained in females, one in March and another in July. This increase in body weight can be attributed to pregnancy (Fig. 2a, b). Male and female body weight over the seasons is significantly different (df=1,22; F=8.88; P=0.007).

There are two peak reproductive periods in a year, in March and in July. During these months, most of the captured females were pregnant and lactating, while the captured males had prominent testes (Fig. 3). During the study period, the recapture rate was 2.71% and in all

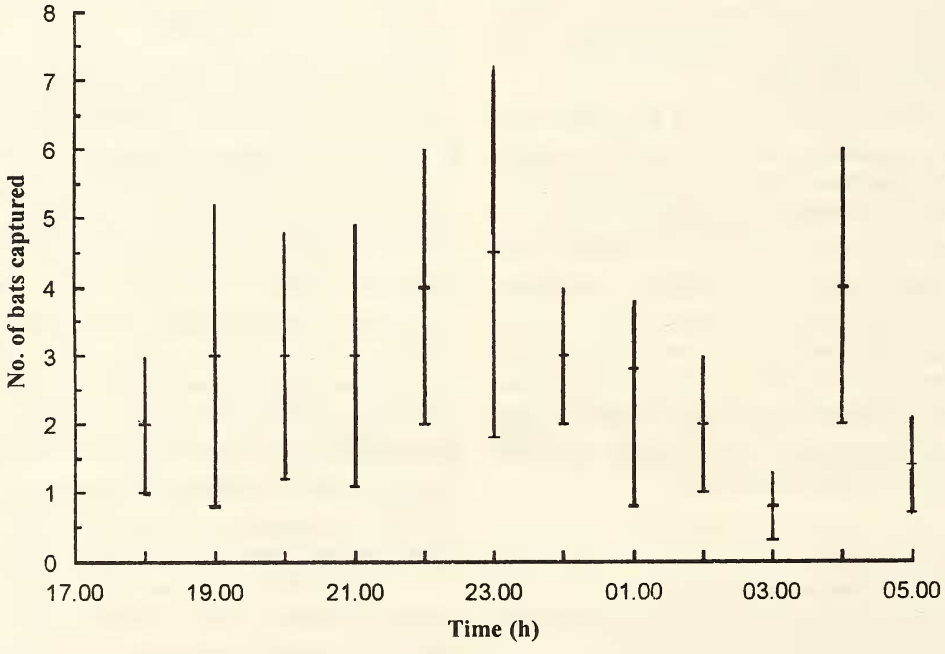

Fig. 1: Foraging pattern of *Cynopterus sphinx*. (The number of bats captured during every hour is the X ±SD of cumulative values of number of bats captured in hourly durations throughout the year)

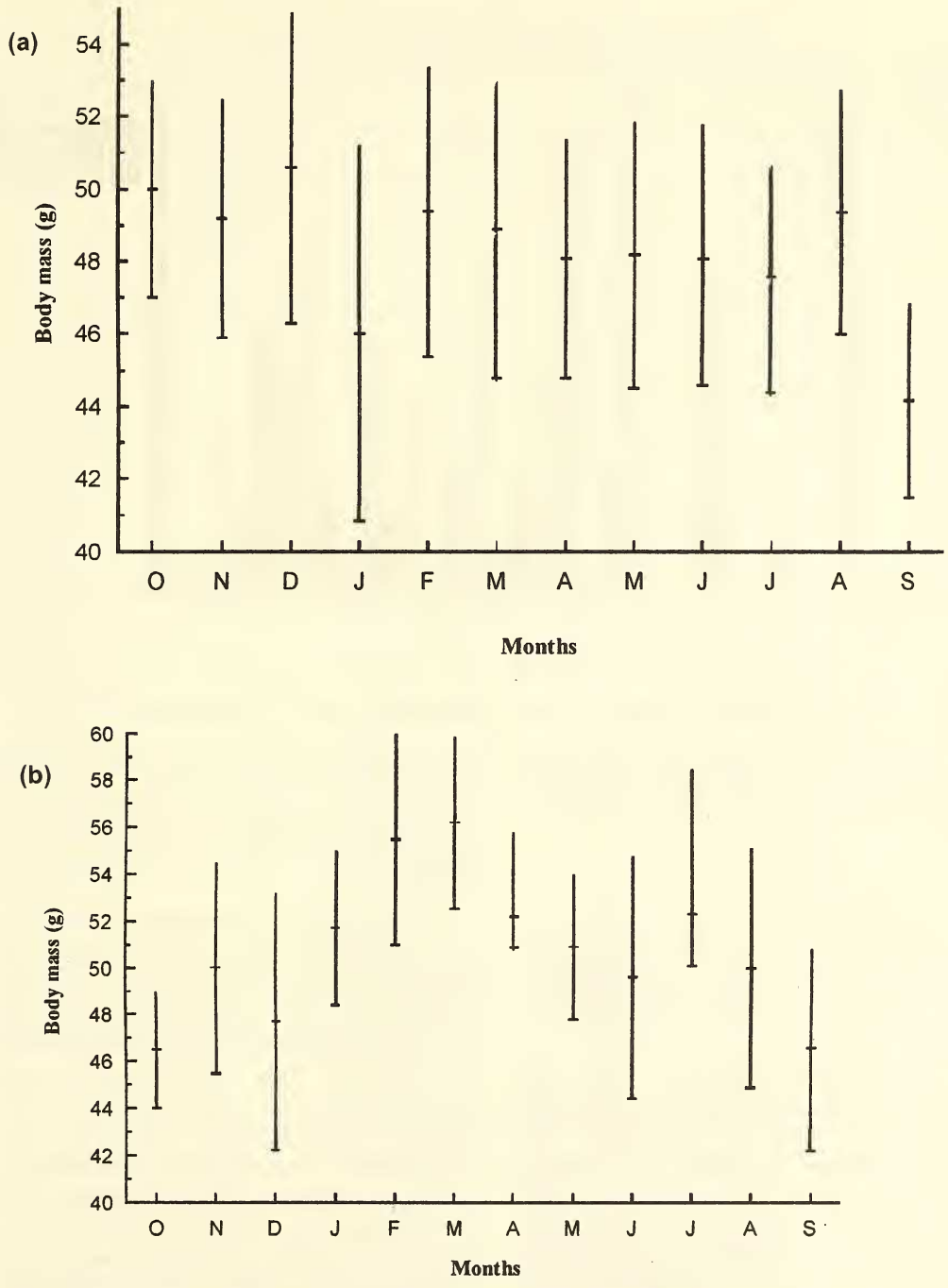

Fig. 2: Seasonal changes in the body mass of *Cynopterus sphinx* a) Male, b) Female

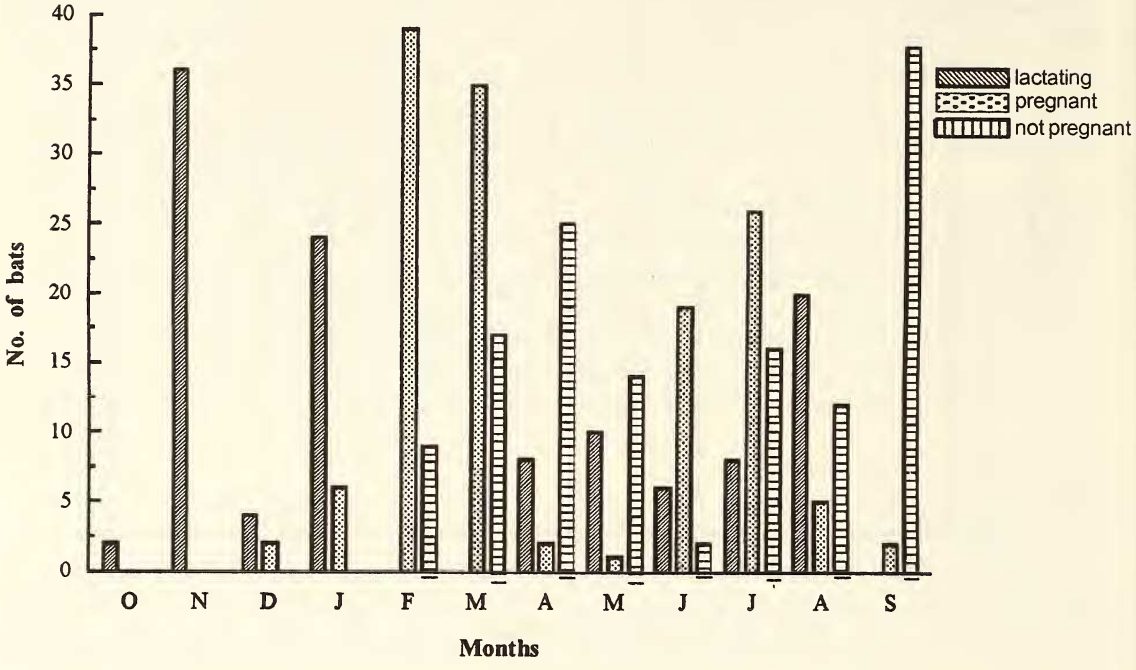

Fig. 3: Reproductive status of *Cynopterus sphinx* during different months compiled values for 2 years

the recaptured bats (21 bats) the necklace was intact. Both male and female bats were recaptured (Table 1).

Discussion

The year round captures of bats, banding and recapture data shows the distribution, foraging time and reproductive periods of *Cynopterus sphinx*.

Most of the mist-netted bats were *C. sphinx*, indicating that this species flies 2 to 4 m above ground level. The body weight of both the sexes changes seasonally. The foraging pattern was observed indirectly from the rate of mist-net capture at every hour from dusk to dawn. Peak captures were observed between 2200 to 2300 hrs, suggesting a predominant foraging activity period. The second, smaller peak at 0400-0500 hrs, may be return flights from the foraging area. Bimodal activity patterns are generally characteristic of insectivorous species. By contrast, unimodal patterns are dominant among frugivorous and nectarivorous species (Fleming 1982).

The maximum and minimum number of *C. sphinx* captured in a single night occurred in September and October respectively, even though fruiting was scarce in this period in our study area. There were only a few large *Polyalthia* trees with plenty of fruit, which attracted a large number of *C. sphinx* in and around Site I. The large number of *C. sphinx* netted from Site I indicates that fruit bats are easily attracted to any rarely occurring fruit during lean periods. The lowest capture normally occurred in places where there was no fruit. A detailed study on the flowering, fruiting and availability of food items during different months has already been carried out by Rajan *et al.* 1999.

TABLE 1
MARK AND RECAPTURE DATA OF *CYNOPTERUS SPHINX*

S. No.	Tag No.	Sex	Status of *C. sphinx* at the time of capture						Status of *C. sphinx* at the time of recapture						Maximum Distance
			Site	Date	Age	Rep	FA	B. Wt.	Site	Date	Age	Rep	FA	B. Wt.	
1.	367	F	A	11.x.1996	JU	NP	59.3	32.4	A	11.xi.1996	SA	NNP	64.5	36	—
2.	822	F	B	19.viii.1996	A	NP	67.7	35	C	29.xii.1996	A	NP	68.1	45	1 km
3.	387	F	C	2.xi.1996	SA	NNP	62.4	35	C	29.xii.1996	SA	NNP	66.7	43	—
4.	818	M	C	2.xi.1996	A	TP	68.1	55	C	29.xii.1996	A	TP	68.1	51	—
5.	252	F	C	2.xi.1996	SA	NNP	63.3	39	C	29.xii. 1996	SA	NNP	66.4	35	—
6.	43	M	D	17.xi.1995	SA	TNP	67.0	44	I	7.iv.1997	A	TP	68.1	48	400 m
7.	4	F	D	17.xi.1995	A	NNP	67.3	42	I	7.iv.1997	A	NP	67.4	50	400 m
8.	6	F	D	17.xi.1995	SA	NNP	67.2	44	I	7.iv.1997	A	NP	69.1	51	400 m
9.	8	F	D	17.xi.1995	SA	NNP	68.3	46	I	7.iv.1997	A	NP	66.2	45	400 m
10.	796	M	A	8.viii.1996	A	TNP	66.0	54	A	2.v.1997	A	TNP	66.4	49	—
11.	21	M	E	27.xii.1996	A	TNP	66.2	48	D	11.v.1997	A	TNP	67.5	49	—
12.	839	M	A	8.viii.1996	A	TNP	65.7	47	C	24.vi.1997	A	TP	70.5	51	7 km
13.	30	F	F	12.iii.1997	SA	TNP	66.2	45	A	30.vi.1997	A	TP	69.4	50	1 km
14.	120	M	A	2.v.1997	JU	GU	62.7	32	A	22.vii.1997	SA	TNP	70.3	44	—
15.	701	F	G	11.iv.1996	A	NNP	69.0	52	J	30.vii.1997	A	NP	70.6	66	4 km
16.	887	M	D	28.ii.1996	A	TNP	65.6	45	J	30.vii.1997	A	TNP	69.5	50	500 m
17.	99	F	H	7.iv.1996	SA	NNP	65.3	44	J	30.vii.1997	A	NP	66.7	48	50 m
18.	91	F	H	7.iv.1996	A	NP	70.1	54	I	31.vii.1997	A	PRG	67.3	59	—
19.	89	F	H	7.iv.1996	SA	NNP	69.2	46	I	31.vii.1997	A	LAC	71.6	45	—
20.	66	M	D	17.xi.1995	A	—	67.5	47	I	31.vii.1997	A	TP	70.4	52	400 m
21.	77	M	D	17.xi.1995	A	—	66.8	46	I	31.vii.1997	A	TP	69.3	42	400 m
22.	79	F	H	7.iv.1997	A	NP	71.1	49	I	15.ix.1997	A	NP	71.3	45	—
23.	260	M	H	31.vii.1997	A	TP	65.5	47	I	15.ix.1997	A	TNP	66.6	43	—
24.	239	F	I	30.vii.1997	JU	NP	65.6	34	I	15.ix.1997	SA	NNP	65.8	32	250 m
25.	70	F	J	7.iii.1996	A	NP	69.6	59	I	15.ix.1997	SA	NP	71.6	46	200 m
26.	86	M	H	7.iii.1996	A	TP	65.4	49	I	15.ix.1997	A	TP	72.8	49	—
27.	231	F	H	31.vii.1997	A	NP	72.8	52	I	15.ix.1997	A	NP	72.8	49	—
28.	259	M	H	31.vii.1997	A	TP	69.2	49	I	15.ix.1997	A	TP	69.2	47	—
29.	271	F	K	4.viii.1997	A	NP	69.1	43	I	15.ix.1997	A	NP	69.2	46	400 m
30.	246	M	H	31.vii.1997	SA	TNP	67.9	39	I	15.ix.1997	A	TP	64.5	45	—
31.	214	F	I	31.vii.1997	SA	NNP	70.5	46	I	15.ix.1997	A	NNP	70.5	41	250 m

NNP- Nipples not prominent, NP- Nipples prominent, TP- Testes prominent, TNP- Testes not prominent, PRG- Pregnant, LAC- Lactating, A- Adult, SA- Subadult, JU- Juvenile, FA- Forearm length, B.Wt.- Body weight

Compared to other species of bats in the study area, *C. sphinx* seemed to emerge from and return early to its roosts. The recapture of *C. sphinx* was not high because of our choice to erect mist-nets in the same site during the whole year. Our mist-netting experience for one year confirms that *C. sphinx* remembers capture sites and avoids flying into the same nets again.

The mist-netted samples from different places helped us to assess the distance traveled and the areas visited by the bats during foraging. In one such recapture, we caught a male bat 7 km away from the original banding site. Normally, males do not travel such long distances (Marimuthu *et al.* 1998). The flight could have been exploratory.

The poor condition of bats in the dry season by reducing net energy intake and reducing fat

stores could be an adaptation to reduce energy consumption during the lean time (Freed 1981, Noberg 1981). That is, individuals may let their weight drop in the dry season to reduce absolute energy requirement. Fleming (1988) reported that body mass in adults of both sexes of *Carollia perspicillata* changed seasonally. Adult *C. perspicillata* were generally lighter in the dry season than in the wet season. In male *C. sphinx*, no significant variation in body mass was observed during the year. Unlike the new world bats and temperate bats, generally no significant variation in body mass has been observed among tropical bats in an annual cycle, as seasonal changes in climate and food abundance are not marked in the tropics. This study corroborates the data collected during histological studies on the breeding habits of *C. sphinx* (Krishna and Dominic 1984, Sandhu 1986).

The capture of lactating mothers, immediately followed by capture of volant juveniles in mist-nets, shows that the young ones are "guided" by the mother bats during initial foraging attempts (Radhamani 1996). We observed that when individual volants are removed from the nets, they make distress calls, attracting the attention of several mother bats of the same species.

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